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Experiences of Artificial Intelligence Application at International Level

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Abstract

Informatics and communications have revolutionized different sectors the energy is one of them through the application using the smart grid in the research exposes its importance in the new vision of the transmission and distribution of electric energy according to the implementation of Distributed Generation with the contributions of different energy sources from different points close to the consumer. The support of this new approach based on current technological advances, with intelligent instrumentation that supports these working methods, has taken into account the incorporation of these techniques as a fundamental tool for the successful decision making. Provides security, security of supply, reliability and energy savings, which translates into the achievement of energy efficiency in the grid system.

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1. Introduction

At present it is impossible to imagine the performance of society in the industrial sphere, services and the home without the use of electric power, which is conceived from the operation of the different equipment that provide comfort for daily life, such as the necessary supply For all the machinery, tools and processes that guarantee our needs.

In order to continue enjoying the benefits of the use of electric energy, it is necessary to make the different systems that guarantee energy supply more efficient, in a similar way, it is required that users or clients reach a level of awareness and Energy saving culture.

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Renewable energy sources (RES) that offer the nature of clean energies that do not pollute the environment and are not depleted as it is solar photovoltaic, the wind, hydraulic and others are being introduced to the electrical system at different points of the large transmission, distribution and low voltage networks. The control, analysis, and regulation of their behavior must be controlled so that users can count on high-quality electrical service.

An important paradigm in our time is the optimum use of the available energy, advocating energy efficiency in the different work scenarios where it must be kept in mind that as the generation is approached the consumer, the transmission and distribution losses of the systems are reduced electrical, giving way to the new form of generation as it is the GD.

To manage with effectiveness and efficiency this new conception of electrical system arise the so-called smart grid, that are the electrical networks that are incorporated to manage the energy and to support the making of suitable decisions, these have different techniques the most used is artificial intelligence, these are providing a qualitative leap in the management of energy resources, favoring environmental protection and responding to the quality requirements of services and products.

2. Materials and Methods

It is part of the inductive-deductive method, where certain premises have been valued to obtain as a conclusion a general approach that allows demonstrating the potential of technologies associated with artificial intelligence, in order to provide sustainable solutions to the current energy system. Based on a bibliographical analysis related to the artificial intelligence applied to the electric power systems, an assessment is made of the usefulness of these technologies for the future development of the electrical infrastructure, especially in the systems of transportation and distribution, thus favoring the reduction of environmental pollution caused by centralized systems and the proposal of distributed generation using the potential of renewable sources that can provide sustainable solutions to the current global problems.

3. Results and Discussions

3.1 Smart Grids

Conceptually, the intelligent network is defined as the one that integrates the centralized generation through large generating plants, with distributed small-scale generation of RES, in which the user can consume and send energy to the network, that is, the side of network demand can be converted in a controlled manner into a "source" or a "well" of energy (Dobakhshari *et al.,* 2011), where information technologies (ICTs) are traditionally used in association with systems of administrative information and the technologies of operations (TO) with field equipment connected to the electrical system, in figure 1, the schematic of an intelligent electrical network is shown.

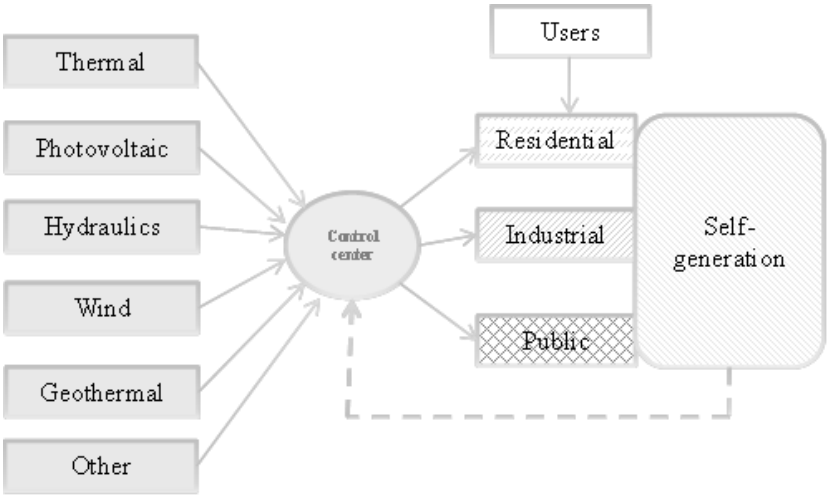

Figure 1. Smart grid

Smart Grids are based on incorporating traditional electronic devices such as meters, sensors or controls into the traditional electrical grid; Linked through different communication technologies, achieving the centralization and use of information for the benefit of all the actors involved, optimizing the operation of the electrical system. In this way, it is possible for consumers to efficiently manage their assets and for the end-user to manage their consumption rationally (Dobakhshari *et al.,* 2011).

The concepts linked to smart grids represent a break with the traditional philosophy of consuming all of the energy from a centralized electrical system, based on large generation plants with an extensive system of transportation and distribution of electricity to its final destination. The system's built-in intelligence allows it to help meet growing electricity needs, raise service quality, increase efficiency by reducing losses, promote the preservation of natural resources and minimize environmental impact by helping to limit CO_2 emissions To the atmosphere.

3.2 Artificial intelligence (AI)

In order to approach the concept of artificial intelligence, one might first ask the question "what is intelligence?" This is doubtless a difficult question whose answer has not yet been fully resolved, which continues to disconcert biologists, Psychologists, and philosophers. One could start by highlighting some general properties that human intelligence presents, such as the ability to face new situations, the ability to solve problems, answer questions, draw up plans, and so on. The ability to solve problems, answer questions and develop plans.

From its beginnings, the man represented the real world through symbols, which constitute the basis of human language, is made up of strings of characters representing concepts of the real world. In fact, symbolic processes are an essential feature of AI.

But the field of artificial intelligence (AI) goes beyond: it not only tries to understand but also strives to create intelligent entities, constituting one of the sciences that have a recent emergence (Fossati Juan, 2011). At present it, with the capacity to synthesize and automate intellectual and technical tasks being potentially relevant to any sphere of the development of covers a great variety of subfields society, being a genuinely universal and versatile field (Fossati Juan, 2011).

Although it is not easy to conceptualize in relation to the definition of AI, it can be said that in the most basic way it is understood as the development of methods and algorithms that allow computers to behave intelligently (Herrera Jorge, 2009). Artificial intelligence is based on knowledge. There are three models that researchers have traditionally used for manipulation, observed in figure 2 (Huacuz Jorge, 1999):

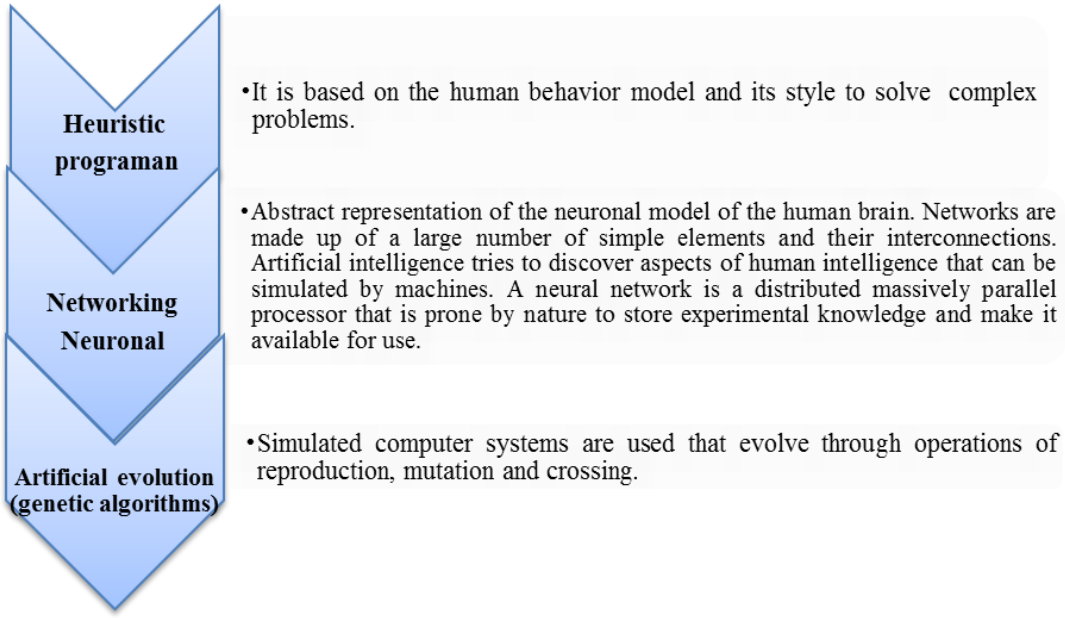

Figure 2. Traditional models

These models show the importance of the different applications of AI in the energy sector and especially to respond to the priorities of improving the quality of service and reducing the environmental impacts associated with the generation of electricity

3.3 The current international situation

At present, the base generation that supplies thermal electricity through the consumption of oil, in addition to polluting the environment contributes to the exhaustion of natural resources. The highest percentage of losses due to transportation and distribution of the electricity system is also due to the traditional transmission and distribution of power from the generator to consumer over long distances. Adding in this regard also the interruptions of the electric service, this harms the customer.

The fundamental architecture of the current electricity grid, vertical in its operation (generation-transmission-distribution) and with unidirectional energy flows has begun to change, as a result of the introduction of new technologies that participate in the generation of electric energy and of advances In information and communications technologies (Huacuz Jorge, 1999).

It should be noted that the global energy situation has begun to present its first symptoms of acute crisis, led to the instability of oil prices and the current war races in the Middle East due to the domination of hydrocarbon deposits, something that demonstrates the despair of the great transnational oil companies before the exhaustion of the valuable resource. In these conditions, human society warns of the need to focus attention on nature and take advantage of the clean and inexhaustible energy that it offers

Over time, the electricity grid has not undergone structural changes to adapt it to the new conditions and requirements, but electric service continues to be a mobilizer par excellence of economic and social development. For its part, AI has confirmed correspond to a multidisciplinary area, which through sciences such as computing, mathematics, logic, and philosophy, studies the design and creation of technological systems capable of solving everyday problems by themselves, using as Paradigm imitation of human intelligence.

In view of the increasing complexity of electricity networks and the increase of electricity transport voltage, it is essential to forecast the probable values of transient overvoltage's caused by network maneuvers (Herrera Jorge, 2009). The electricity network of the immediate future requires a qualitative leap in the structural and functional, which allows better management of resources, drastically reduce losses, promote the conservation of natural resources, promote environmental protection and respond to increasingly demanding requirements of high-quality electrical service and excellence. In the last decades, the world has experienced a significant increase in the demand for electricity, which has caused widespread concern about the future problems of energy in terms of sustainability. This situation has led the scientific community to seek solutions that allow efficient, reliable and responsible use of energy through a more flexible and optimized conception of the electricity grid.

In this scenario, the network and the applications of the AI go hand in hand in the emergence of a new paradigm that is known as an intelligent electrical network (Medina Ricardo, 2012). Decision making in the aspect of transients occurring in electrical systems is achieved by the use of artificial intelligence for its solution, as well as being able to operate in a frequency domain, can take into consideration the exact values of All network parameters involved in the study. The technical elements that currently make up the AI can conveniently accelerate the processes of calculation and decision making (Herrera Jorge, 2009). The new technologies where AI is incorporated in the electrical system allow greater transparency in terms of consumption and costs, the consumer decides how much electricity to consume and where that electricity comes from; In addition to optimizing generation, support the development of a more efficient, reliable electrical system and intelligent electrical distribution.

3.4 The benefits of incorporating AI to the electrical networks

Integrated AI requires the incorporation of innovative equipment and services, along with new communication, control, monitoring, and self-diagnosis technologies, which will help achieve the following objectives (Dobakhshari *et al.,* 2011): Strengthen and automate the network, improving the operation of the network, quality indexes and losses in the network; Optimize the connection of areas with renewable energy sources, improving connection capabilities and minimizing the cost of connecting them; Develop decentralized generation architectures, allowing the operation of smaller installations (Distributed Generation) in harmony with the system; Improve the integration

of intermittent generation and new storage technologies; To advance in the development of the electricity market, making possible new functionalities and services to marketers and consumers; Active demand management, allowing consumers to more efficiently manage their consumption and improving energy efficiency.

The possibility of combining conventional electrical technology with information and communication technologies (ICT), as well as modern miniaturized control systems, makes it possible to expand and increase the "intelligence" of today's electrical systems. The new electric systems will offer new services, both for the homes and for the companies, which will allow using the energy of a more efficient and safe form.

The new solutions for the operation of electricity networks are based on the use of communication channels and intelligent electronic devices that make possible a two-way flow of information and decision-making in a decentralized way, allowing a greater degree of interaction and coordination between consumers And energy producers, which gives rise to new models of relationship and business between both parties. Nowadays neural networks are used for the planning of electrical systems for decision making, in figure 3, the use of neural networks can be observed in the planning of electrical systems and decision making in different scenarios.

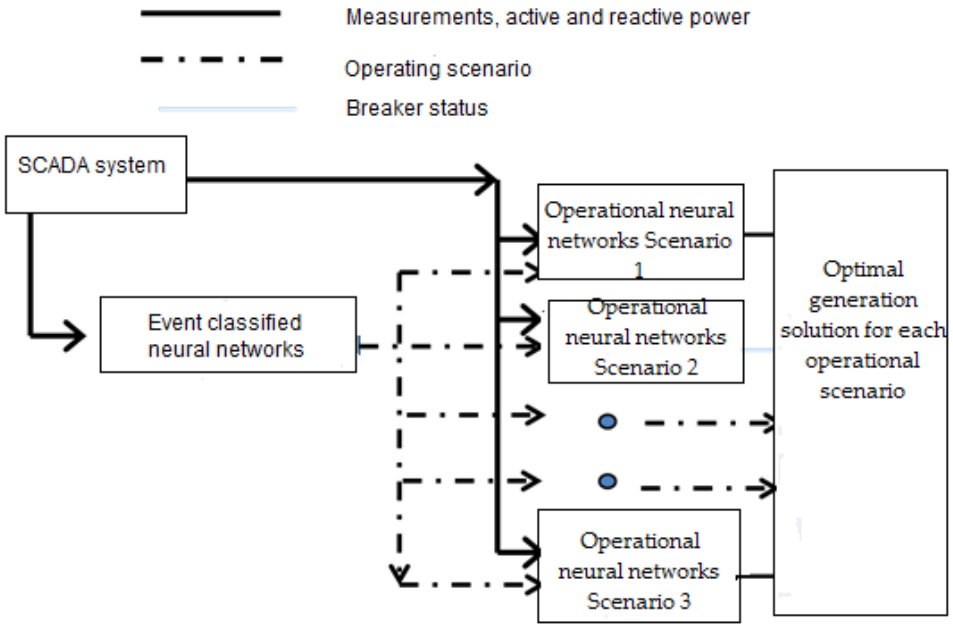

Figure 3. Neural networks in the planning of electrical systems

The consumers cannot regulate and program their consumption according to the price of electricity in a dynamic way, however, if it is possible to manage the energy supply in a home or a company in an individualized way, with a real-time exchange of information between The generation and consumption side, it would be possible to rationalize the use of electric energy, which, at present, is not optimally used in most cases due to the lack of automation and control in all its value chain. It is highlighted that the intelligent control of the electric demand can achieve savings in the energy bill in homes and small businesses of up to 30%.

3.5 The technology available to ensure the use of smart grids

The application of intelligent devices to both sides of the power line, with communication between them and the ability to program actions according to the boundary conditions, will allow the creation of complex intelligent networks in neighboring communities, in companies or in family units, with High capacities of interaction and intercommunication that will change the paradigm of energy use. This new model will become more important when distributed generation systems, based on renewable (photovoltaic), are widespread in the residential, commercial and industrial sectors. At that moment, the energy consumption will lose its traditional role, to become producer-consumer, that is, it will become a prosumer. In this scenario, communication networks, responsible for the exchange

of information with the environment and intelligent systems, necessary for the decision making in an automated way, will be essential in the correct operation of the smart grids.

At present, they are the beginnings of the development of smart grid, although countries such as the United States or the European Union (EU) themselves already have them very present in their R + D + I policies, whether public or in collaboration with private companies. In the United States, a lot of resources has been planned for research programs, while other specific initiatives have been launched by the EU with community funding lines. An interesting project carried out in the European environment has been Ownership (Energy-saving information platform for generation and consumption networks), An interconnected platform of consumers which showed that the interaction between the consumer and the energy producer allowed savings of up to 30% in electricity consumption, equivalent to a 9% reduction in greenhouse gas emissions.

Interconnected building; shared databases, distributed and renewable generation, energy storage, electric vehicles, home automation, home robots, programmable and intelligent appliances too. They are incorporating a set of new actors that will surely change the services offered by the distribution and marketing companies, as well as the customs of the citizens in terms of energy consumption, always thinking only of the low voltage network.

When this high degree of automation and advanced control is extended to distribution networks in medium voltage, even to the transmission networks, which interconnect large areas in high voltage, it will be possible to achieve important benefits in the reliability and safety of networks, in the energy management of companies, in the cost of energy and in production processes.

For the development of intelligent electrical networks there are two challenges to solve at the moment: On the one hand, there are great investments necessary to develop all the opportunities that now arise. The roadmap marked by the International Energy Agency (IEA) estimates that, in R & D & I activities alone, it will be necessary to invest more than $ 10 billion by 2050 in the area of smart grid; On the other hand, a greater degree of involvement on the part of governments and institutions is necessary. The great advances of REI can not materialize with the encouragement of private initiative alone, but it is necessary to have public support in terms of both financial and social integration and regulatory standards.

3.6 The international trend

The fundamental architecture of the current electricity grid, vertical in its operation (generation-transmission-distribution) and with unidirectional energy flows has begun to change, as a result of the introduction of new technologies that participate in the generation of electric energy and of advances. The adoption of the model of distributed generation goes hand in hand with the application of the microgrids; Intelligent Networks and Artificial Intelligence Devices, capable of offering novel technical solutions when properly combined with the centralized system (MEER, 2015).

The development of the power electronics, the improvement of the reliability of the communications and the increase of the capacity of the means of storage, has led to consider the microgrids as the previous step to the intelligent systems [8]. The society now recognizes that economic development trends are not sustainable. Beyond this there is little agreement on opinions, there is a discussion about the meaning of sustainable development and whether or not it is affordable and there are different views about how sustainable societies will look and how they will work. Lack of agreement and definition at the international level has hampered efforts to make progress on sustainable development (US Department of Energy, 2001).

Conceptually it can be accepted that sustainable development constitutes a strategy that brings into play an integrated process, through which are intentionally operated new ways of generating in human beings and in human societies significant changes in behavior and significance of cultural, social values, Political, economic and those related to nature, while facilitating and facilitating the development of intellectual and physical abilities, promoting the active and determined participation of individuals on a permanent basis; Reflecting a better human intervention in the environment and as a consequence an adequate quality of life for present and future generations. In this scenario, the technical design of the current centralized oil and electricity system, an environmental pollutant and a natural loss generator, may call into question the efforts that are made on a technical scale to achieve sustainability and where it may be necessary to restructure the current system incorporating Innovative solutions linked to the Distributed Generation, with the incorporation of the different renewable sources of energy

3.7 Equipment and Instrumentation required

Among the most relevant technologies are portable equipment (multimeters, harmonics meters, oscilloscopes for transients and multifunctional equipment), to complete systems for monitoring (determination of the system configuration, calculation of energy quality performance indexes, systems Intelligent monitoring systems and Internet-based systems) (Velázquez Raúl, 2010). The milestones of intelligent electricity grids represent the foundation of the smart grid. This requires the implementation and integration of each of the different technologies and their applications. In each case, this relationship will depend on multi-residential and the specific circumstances of the actors involved in each system.

The immediate results are as follows:

Consumer Empowerment: Empower consumers by giving them the information and education they need to effectively use the new options provided by the smart grid. This includes advanced solutions such as infrastructure metering, home area networks with home screens, energy resource distribution, and demand for response programs as well as application updates and useful information technology architecture that will support integration for the Better future of REI technologies.

Distribution of advanced operations to improve reliability: Includes solutions such as intelligent sensors and control devices, cutting, advanced management, distribution and management control, automation systems, geographic information, and other technologies.

Advanced transmission operations: will integrate the distribution system, including substation automation, power electronics, advanced monitoring and protection systems, schematics, as well as modeling, simulation and visualization tools to increase knowledge of the situation and provide better communication in the transmission processes, In the figure 4 shows an outline of how the transmission and control of energy would be and by integrating artificial intelligence into the network.

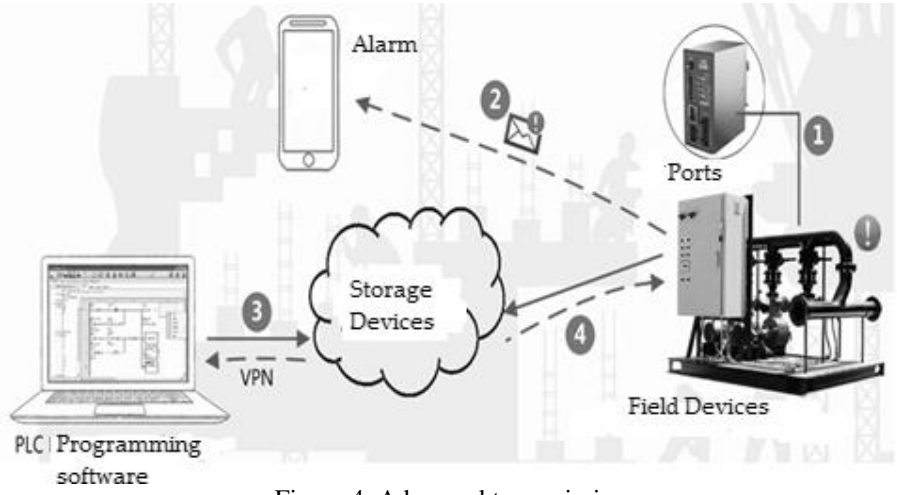

Figure 4. Advanced transmission

As can be seen here, intelligent bi-directional meters are integrated, which are used to provide high separation rates between the micro-network and the main network; In addition to how information technologies are integrated with the operational technologies, these systems allow the integration of other previously unmonitored variables such as pollution levels.

4. Conclusion

The research allowed to verify that it is of interest to the international scientific community the use of artificial intelligence, to provide the necessary coverage in terms of the decision making in the electrical networks resulting in a change in the conception of traditional transmission and distribution and Move on to a new stage that is imposed with the implementation of distributed generation and the incorporation of renewable energy sources.

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Statement of authorship
The authors have a responsibility for the conception and design of the study. The authors have approved the final article.

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